California Energy Commission
Public Interest Energy Research (PIER) Program
TRANSPORTATION ENERGY RESEARCH

Automotive Thermoelectric HVAC Development and Demonstration Project

Research Powers the Future
PIER Transportation Research
www.energy.ca.gov/research/transportation/

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Fact Sheet

The Issue

Approximately 800 million gallons of gasoline are consumed annually in California for the purpose of cooling occupants in light-duty vehicles, resulting in a higher demand for petroleum and increased reliance on foreign oil. In addition, the typical vapor compression automotive air-conditioner design uses R134a refrigerant and has an inherent leakage rate averaging 40 grams of refrigerant per year. The R134a leakage rate contributes to approximately one million tons of carbon dioxide (equivalent) per year of additional emission releases. Electrification of automotive systems using thermoelectric cooling would significantly reduce the demand for petroleum and provide a clean alternative to a conventional air-conditioner system.

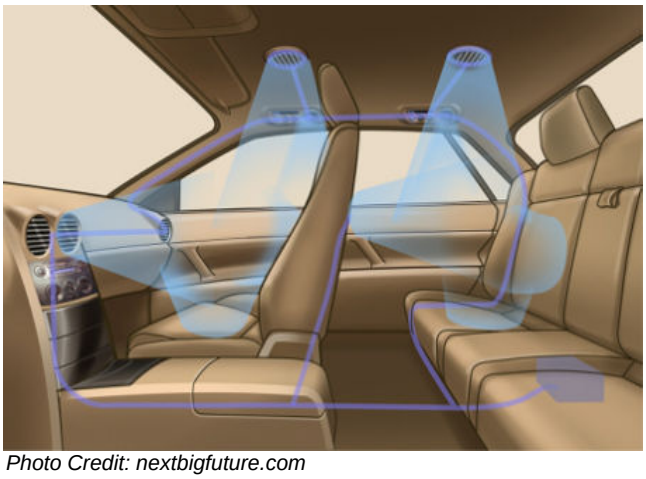

Photo Credit: nextbigfuture.com

Project Description

This research will develop and demonstrate an operational and economically-viable thermoelectric Heating Ventilation and Air Conditioner (HVAC) system that can replace or downsize the current vapor compression air conditioner in automobiles. The project includes integrating a thermoelectric HVAC into a current production model vehicle, delivering a vehicle to the U.S. Department of Energy for further verification and analysis, and demonstrating the functionality of thermoelectric HVAC system at a California site. Increased efficiency will also be achieved by incorporating thermoelectric waste heat generators into the system design to convert waste heat (exhaust gas) into electrical energy.

PIER Program Objectives and Anticipated Benefits for California

The State Alternative Fuels Plan presents scenarios for increased use of alternative fuels and vehicle technology efficiency improvements in order to reduce petroleum consumption and greenhouse gas emissions. If successful, this project will demonstrate a minimum of 33 percent improvement in the energy consumed by a vehicle air conditioning system. Development and demonstration of a thermoelectric HVAC system will benefit California by:

- Reducing fuel consumption in the transportation sector.
- Reducing the need for harmful refrigerants.

The thermoelectric HVAC will be optimized to provide occupant comfort while reducing fuel consumption and greenhouse gas emissions. To maximize energy efficiency, the thermoelectric HVAC system will use distributed cooling/heating design that targets individual occupants and reduces temperature conditioning to unoccupied passenger seating.

Project Specifics

Contract Number: 500-08-047
Contractor: National Energy Technology Laboratory
Contract Amount: $2,000,000
Match Funding: $11,871,918 Ford and General Motors
Contract Term: June 2009 to November 2012

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